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ILLUMINATED PUSH-BUTTON SWITCH

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16. Abstract The patent describes an illuminated push-button switch characterized by the fact that it consists of a switch group, an operator button opening and closing the switch group, a light-emitting element which illuminates the face of the operator button.					
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Application for Patent

*/1

Name of Patent

Illuminated push-button switch

Range of Patent Application

1. The present invention is an illuminated push-button switch which is distinctive in consisting of an appropriate switch group, an operator button which opens and closes the switch group, a light emitting element which has within it a light emitting diode which illuminates the face of the operator button. The light emitting element and its current limiting resistor are fixed in a holder in the illuminated push button switch contained in the main case. The operator button is held in the holder in such a way that it can open and close the switch freely and be prevented from pulling out. They are fitted in the main case so that the holder and operator button can be removed forcibly. When fitted together, the external terminals of the light emitting element flexibly pressure-contact the terminal block's fixed terminals. These fixed terminals are attached to the lower section of the main case.

2. The present invention is an illuminated push-button switch as described in Paragraph 1 of this Range of Patent Application which is distinctive in having tabs and slots that fix the position of light emitting element and holder.

Detailed Description of Invention

The present invention is an illuminated push-button switch, more specifically, an illuminated push-button switch with an appropriate switch group, an operator button which opens and closes the switch group and a light emitting element consisting of a light emitting diode which projects light to the face of the operator button. The light emitting element and the operator button are both within a main case.

*Numbers in the margin are those of the pages in the original text.

Incandescent bulbs are generally used as the light source for conventional illuminated push-button switches, but incandescent bulbs have several shortcomings, their life is short and they give off a great amount of heat. To overcome those deficiencies, illuminated push-button switches have been developed which use the light emitting diode (LED) for the light source. /2

However, the light emitting element in such devices is fixed in the operator button and the element moves in conjunction with the open and close movement of the operator button. Electrical connection between light emitting element and fixed terminals in the conventional switch must be a conductive spring. This makes the structure of the device complex and reduces reliability. Light emitting diodes come in three colors, red, green and yellow, but since their light emission wave length is short, you cannot simply change a filter and have a wide variety of colors as you can with conventional incandescent bulbs. If you want to change the color of an LED display you have to change the element itself. But it is very difficult to change light emitting elements in a structure where springs form the electrical connections.

We took these shortcomings into account in creating the present invention. This invention provides an illuminated push-button switch with a simply constructed light emitting element and fixed terminals for highly reliable connections and an illumination section with a light emitting device which can be easily changed.

In the following paragraphs we will explain the invention in details and refer to the appended charts.

As both Figures 1 and 3 show, the main configuration of this illuminated push-button switch invention consists of a main case (1), an operator button (10), a light emitting section (20) containing a light-emitting device (21), terminal block (40), and switch group (50).

The illumination section (20) is made up of a light emitting element (21), a holder (30) and a printed resistor (38). The light emitting element (21), as Figure 4 shows, is formed by inserting LEDs (22,22) and leads (23,25) into a transparent synthetic resin (26). The surface of the resin (26) is molded so that it bends the light from LEDs (22,22), balances parallel light and emits it in the axial direction. The holder (30) is molded into the transparent synthetic resin so that it is an integral part of the resin. A bayonet tab (28) is used to position the light emitting element (21). The light element (21) is attached to the holder (30) by inserting (28) into the tubular receptacle (31). At this time lead plate (23) is inserted into a groove (32) in holder (30). The slot (24) in the lead plate (23) is slid into the grooves (32) and fitted to and held by a tab (33). The other lead plate (25) is inserted into slot (34).

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The printed resistor (38) is now attached to the bottom of the holder (30) by a rivet (39). A lead (25) is pushed down through a slot (34) in the holder (30) and is soldered to make an electrical connection with the printed resistor (38). The rivet (39) is made from a conductive material and is electrically connected to the conductor section of the printed resistor (38). The printed resistor (38) is the current limiting resistor for the light emitting element (21).

The operator button (10) is made from a translucent synthetic resin and is colored to match the color emitted by the light emitting element (21). The legs (11,11) on both sides of the operator button fit into the grooves (35,35) on both sides of the holder (30). By being placed in this position, the button can move freely up and down to perform off and on switching. The square-angled step section (12) and the tooth (13) in the legs (11) hold the operator button in position and prevent it from being pulled out. In other words, the illuminating section (20) is a block consisting of an operator button (10), a light emitting element (21), a holder (30) and a printed resistor (38). The operator button (10) is removed from the illuminating section (20) by forcibly withdrawing the legs (11) from the

grooves (35) of the holder (30). The translucent surface (14) on the top of the operator button (10) is molded so that it has the same surface area as the surface (27) of the light emitting element (21).

The block consisting of the operator button (10) and the illuminating section (20) is inserted into the top of the main case (1). The bottom edges of the holder (30) set into a flange (not shown in the illustrations) on the inside surface of the main case (1). The flexible arms (36) slide over and are held in place by the tabs (2) on the inside of the main case (1). At this time, the lead plate (23) in the light emitting device (21) pressure-contacts with the flexible connector (42). The connector (42) is the connector for the fixed terminal (41) of the block (40) and the block (40) is attached to the bottom of main case (1). A rivet (39) is in pressure-contact with the contact (44) of the fixed terminals (43). Each terminal is now electrically connected. The terminal block (40) is made up of the fixed terminals (41,43) which are insert-molded into a terminal base (45) made from an appropriate synthetic resin. One connector (42) is set perpendicularly to the terminal base (45) and moves flexibly in the horizontal direction. Another connector (44) is curved in snake-like fashion, rises at a slant and is flexible in the vertical direction.

The switch group (50) has a bi-polar configuration. The common terminals (54) and the fixed terminals (56,58) are insert-molded into the base (51) which is made of an applicable synthetic resin. The notches (61,61) on the movable strips (60), which contains the contacts (62), are fastened to the notches (55,55) of the common terminals (54), one end of the return springs (63) is attached to the movable strips (60) and the other end is attached to the axis pin (65) of the rotating plate (64). This makes the strip (60) move with a reciprocal action. The rotating plate (64) freely moves the support axis (66), for a support point, setting in the groove (52) (see Figure 2) in the base (51). Due to these rotations, the movable strip (60) moves up and down by snap-action to open and close the contacts (57,59).

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The operator strip (16) is set so that the operator button (10) in the main case (1) will move the rotating plate (64). Fitting the tab (15) on the operator button (10) into the slot (17) in the upper part of the operator strip (16) unifies the operator strip (16) and the operator button (10). The bottom edge of the operator strip (16) is now in contact with the axis (65) of the movable plate (64). The heart cam (18) has been molded into the side of the operator strip (16) and one end of a hook spring (19) is fastened into the bottom edge of the heart cam (18) and the other end connects to the slot in the switch base (51), thus forming a push-push mechanism.

The metal clips (7) on both sides of the main case (1) are attached and fixed to the main case by tabs (3) and slots (8). By clamping the arm (9) of the fastener clip (7) and the flange (4) of the main case (1) to the attachment slots of the panel (not shown), the panel is attached and imbedded.

The illuminated push button switch of this invention has the configuration described here. Normally, as shown in Figure 2, the rotating plate (64) in the switch group (50) moves the support axis (66), the support point, upward by the spring action of return spring (63) and the movable contacts (62) closes the fixed contact (57). Also, the operator plate (16) is pushed up by the axis (65) of the rotating plate (64) and which also pushes the operator button (10) up.

Pressing the operator button (10) presses axis (65) of the rotating plate (64) by means of the operator strip (16), moves the support axis (66), moves the rotating plate (64) upward and reverses the movable strip (60) in the downward direction. The movable contact (62) is switched from the fixed contact (57) to the fixed contact (59) and current enters the light emitting element (21). When pressure is released from the operator button (10), the heart cam (18) keeps the operator button (10) in depressed status and the switch group (50) maintains the above operational status. When the operator

button (10) is pressed again and released, the entire switch returns to the previous state.

The operator button (10) can be forcibly removed from main case (1) in order to change the color of the illuminated push button switch's light emitting element display. To do this, remove the illuminating section (38) consisting of the operator button (10), the light emitting element (21), the holder (30) and the printed resistor (38), by releasing the arm (36) of the holder (30) which fits over the tab (2) in the main case (1). Then reverse the procedure and insert into the case (1) another luminous section (20) with a light emitting element (21) that will emit the desired color and an operator button (10) of a color matching the emitted color. Perform the same operation to change driver voltage and printed resistor of a different value. Remove the operator button (10) and the illumination section (20) from the main case (1). Fit a different printed resistor of the desired value. Then, place the operator button (10) and the illumination section (20) back into the main case (1). The operator button (10) and the illumination section (20) will come apart when removed from the main case (1). Either operator button (10) or illumination section (20) can be replaced by new components and reattached. The two components are separated by pulling the arm (11) in the operator button (10) from groove (35) in the holder (30) and they are attached by fitting the arm (11) to the groove (35).

The light emitting element (21) is formed in such a way that light from the LED (22) goes through the light emitting surface (27) in parallel and in the axial direction. Because the operator button (10) is molded so that its translucent surface (14) has the same area as the light emitting surface (27) and is placed on the same axis as the light emitting surface (27), light from the surface (27) of the light emitting element (21) is projected efficiently through the translucent surface (14) to the outside. If the illuminated push-button switch in this invention is equipped with a different type light source, the distance between the translucent surface (14) and the light emitting surface (27) when operator button (10) is in

- 28.....positioning tab
- 30.....holder
- 31.....tubular receptacle
- 36.....arm
- 38.....printed resistor
- 50.....switch group

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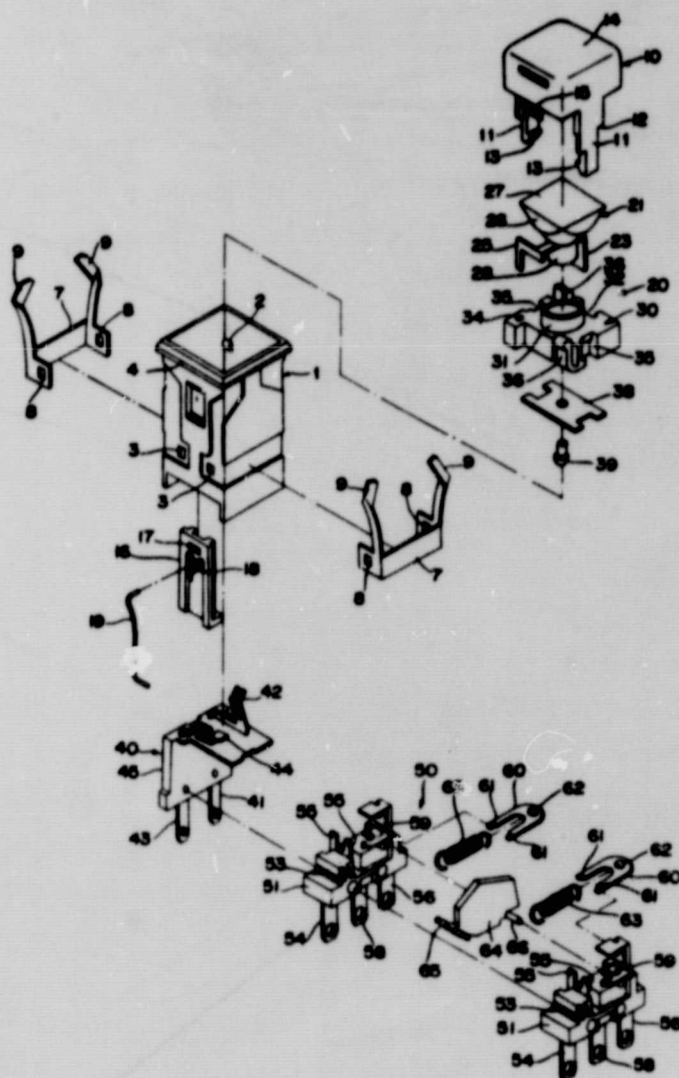


Figure 1

Figure 2

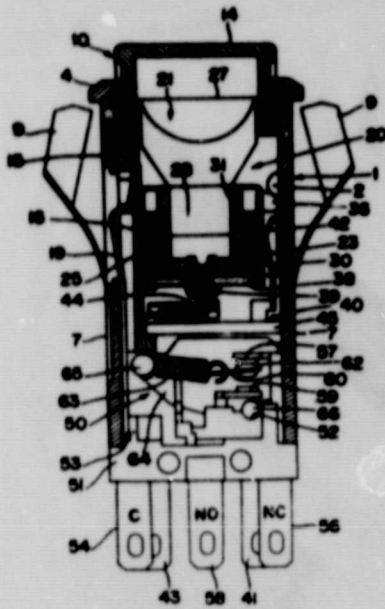


Figure 3

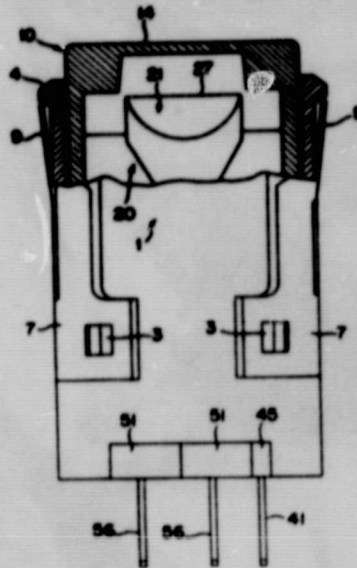


Figure 4

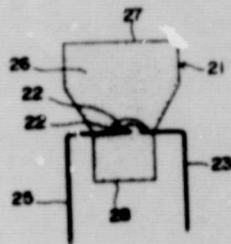


Figure 5

